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O. P. BRYSCH, Editor

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1. MANAGEMENT

Gas Industry Expansion

Current and Future Programs of the Gas Industry. *Public Util. Fortnightly 62,* 647 (1958) Oct. 23 (42 pp.)

Collection of excerpts from statements by gas utility company executives and other officials, based on responses to a request by the editors for information about their particular company plans. Included are Alabama Gas Corporation, American Natural Gas Service Company, Arizona Public Service Company, Arkansas Louisiana Gas Company, Baltimore Gas and Electric Company, Central Hudson Gas & Electric Corporation, Central Illinois Public Service Company, The Cincinnati Gas & Electric Company, Citizens Utilities Company, Commonwealth Natural Gas Corporation, Consumers Power Company, The Dayton Power and Light Company, East Tennessee Natural Gas Co., Greely Gas Company, Illinois Power Company, Iowa-Illinois Gas and Electric Company, Iowa Southern Utilities Company, Laclede Gas Company, Louisville Gas and Electric Company, Michigan Consolidated Gas Company, Milwaukee Gas Light Company, Missouri Natural Gas Company, Montana-Dakota Utilities Company, The Montana Power Company, Mountain Fuel Supply Company, New England Gas and Electric Association, New Orleans Public Service, Inc., Northern Illinois Gas Company, Northwest Natural Gas Company, Oklahoma Natural Gas Company, Orange and Rockland Utilities, Inc., Pacific Gas and Electric Company, Rio Grande Valley Gas Company, Rochester Gas and Electric Corporation, San Diego Gas & Electric Company, Southern Counties Gas Company of California, Southern Union Gas Company, Texas Eastern Transmission Corporation, United Gas Corporation, Washington Natural Gas Company, Western Kentucky Gas Company and Wisconsin Power and Light Company.

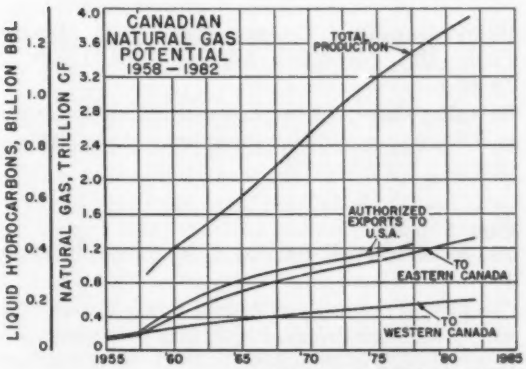
Gas Industry Offers Enormous Potential. E. Gray II. *LP-Gas 18,* 74 (1958) Oct.

On a reasonable basis of growth, it is expected that by 1975 LPG will have expanded to about 20 billion gal/year. This is about one-third better than anticipated for the gas industry. But LPG is moving forward faster than the gas industry as a whole.

Recent Trends in the Industrial Utilization of Gas. S. G. Aberdein and A. E. Tyrell. *Gas J. 296,* 144 (1958) Oct. 1 (10 pp.)

Course of British gas industry in critical years ahead is clearly defined. At present it provides 5% of industry's fuel needs in gaseous form and up to 5% more as coke and liquid fuels derived almost wholly from indigenous sources at production efficiencies which are continually rising and are now 77.8%. Utilization efficiencies vary considerably from process to process and much attention is paid by gas equipment designers to the need for efficiency so that advantage gained in higher production efficiency is not lost in plant of low efficiency. It is vital to needs of high quality and increased volumes of production that adoption of automatic process and product control should continue.

Potential Production of Pipeline Gas and Liquid Hydrocarbons in Western Canada, 1958-82



(Adapted from *Healthy Manhood Is Predicted* . . . See abstract, p. 303.)

Gas Industry Management

What Is Adequent Stand-by Capacity? L. B. Bowman. *Public Util. Fortnightly 62,* 638 (1958) Oct. 23 (9 pp.)

Down-to-earth practical exposition of difficult problem. Not only are suggestions made for what stand-by capacity should be, but a six-point procedure is outlined enumerating intelligent steps to achieve adequate stand-by capacity.

Gas Builds a Greater America. R. W. Otto. *Public Util. Fortnightly 62,* 601 (1958) Oct. 23 (8 pp.)

While manufacturers of electric appliances and equipment are spending six cents out of every revenue dollar for product research, the gas appliance manufacturers are spending far less than one cent/dollar of revenue. Major problems facing industry are increased costs, more customers, keener competition, improvement of appliances, clarification of regulation, and unity from production to customer service.

Some New Facts and Ideas on Utility Financing. F. J. McDiarmid. *Public Util. Fortnightly 62,* 729 (1958) Nov. 6 (13 pp.)

Penetrating study of "operating public utility bonds" —their past history of performance, their declining

popularity, their relation to preservation of values and guide on how they can be tailored to financing needs of their best market.

Utility Executives' Compensation. L. S. Munson. *Public Util. Fortnightly 62,* 742 (1958) Nov. 6 (4 pp.)

Revealing survey of top management compensation in which comparisons are made between the financial company key personnel.

Gas Supply

TGT Bounces Back. *Oil Gas J. 56,* 94 (1958) Nov. 10.

Company is returning to Federal Power Commission with a stronger proposal split into two parts after being rebuffed in its first bid to crack upper Midwest gas market. Included are new U. S. line for Chicago-Gary area; gas supply of 360,000 MCF/day in contrast to 115,000 MCF/day and a plan not tied to Canadian supplies. Instead of selling directly to large industrial users, Midwestern would sell to three utilities—Peoples Gas Light & Coke Co., Northern Indiana Public Service Co. and Northern Illinois Gas Co.

Foreign Activities

Nasser Nullifies Syrian Concessions. *Oil Gas J. 56,* 86 (1958) Oct. 13.

United Arab Republic announced annulment of 6000-sq mile area concession granted in Syria three years ago to Illinois drilling contractor. Action came just one week after Cairo Government established a new General Petroleum Authority to control every phase of the oil business in both Syria and Egypt. Government charged that violations caused cancellation.

Reds to Give Gigantic Push to Booming Gas Industry. *Oil Gas J. 56,* 72 (1958) Oct. 20 (2 pp.)

Production timetable for 1965, 14½ billion CF/day, would be more than seven times the 1957 production schedule. U. S. production for 1957 was more than 29 billion CF/day. Russians hope to reach this by 1973. Goals for 1959-65 period include 40 new trunk lines; drilling program of 49.2 million feet of "deep" exploratory gas wells; extension of gas service to more than 300 additional cities; increasing proportion of gas in Russia's fuel balance from 6.5% in 1958 to 21% in 1965, and expansion of drilling equipment manufacture.

Imports

Proposed Oil Import Program. *Independent Petrol. Assoc. Monthly 29,* 27 (1958) Oct. (2 pp.)

New program shifts basis for importing allocations from historic imports and provides that all refineries in Districts I through IV will have a share in imports. Before new program gets into final operation, there will be a transition period of one year in which historic importers will reduce their imports.

Federal Power Commission

From Cost of Service to Rate Making. C. H. Frazier. *Public Util. Fortnightly 62,* 616 (1958) Oct. 23 (13 pp.)

Article attempts to answer questions on next steps in regulating natural gas producers, establishment of rates once cost of service has been found, how to divorce considerations of public convenience and necessity from price and derivation of rate-making procedure to expedite small producer cases that burden the FPC.

Current FPC Problems in Gas Regulation. J. K. Kuykendall. *Public Util. Fortnightly 62,* 609 (1958) Oct. 23 (7 pp.)

Pacific Northwest region of U. S. was last major virgin market area to be reached by natural gas via interstate pipelines. As such, it presented special problems of both interstate and intrastate regulations. Outline of some aspects of regulatory problems, many of which are still awaiting solution.

Methane Liquefaction

Stakes High on First Liquid-Gas Cargo. *Oil Gas J. 56,* 47 (1958) Oct. 27 (2 pp.)

Former freighter converted into complex tanker is ready for shake-down runs in gulf for pioneer voyage to England in few months. Success will open up world-wide markets for gas wasting in remote fields. Vessel is jointly owned by British Gas Council and Constock International Methane, Ltd. Ship has been converted at cost of $4.5 million to carry the experimental cargo. Trial runs will take about three months; about first of year, ship will sail from Lake Charles, La., on her maiden voyage.

Pipeline Systems

Computers Analyze Economic Feasibility of Proposed Pipelines. T. R. Young. *Petrol. Eng. 30,* D-24 (1958) Oct. (5 pp.)

Problem of pipeline investment analysis is complex and inherently active because old sources of crude play out and new ones are being discovered. Basically, work is divided into pipeline design, capital and annual operating cost estimates and financial computation. Wherever practicable, output from one program is coupled with subsequent program by common punched card format.

Modernization

How Modern Is American Industry? *Chem Eng. 65,* 113 (1958) Nov. 3 (32 pp.)

Survey reveals it would cost $95 billion to replace today's obsolete equipment. This is a priority job if business is to get costs down for years ahead. Included are a guide to help determine when a plant needs modernizing, use of team approach, new equipment developments and benefits of modernization.

Air Conditioning

Air Conditioning . . . Gas Industry's Hope? G. T. Kellogg. *Public Util. Fortnightly 62,* 629 (1958) Oct. 23 (9 pp.)

Gas industry has already established a defensible beachhead in the residential air-conditioning field. Sales efforts are now being concentrated on homes using gas heat and on the more than one million new homes being built each year. Capturing even a small percentage of this vast market could add a big summer load.

Promotion

Utility Uses Two Programs to Boost Appliance Sales. 1. Salesmen Get Speech Training. *Gas 34,* 63 (1958) Nov. (2 pp.); **2. New Campaign Provides Bonuses for Appliance Sales Leads.** B. Larson. *Ibid., 66* (1958) Nov. (3 pp.)

Public speaking techniques are being applied in effort to push sale of gas appliances at Southern Counties Gas Co., Los Angeles. Same company has added extra incentive through "Blue Flame Load-building Program" which offers cash awards for appliance sales leaders.

Research

Faculty Research, a Developer of Creative Thinking. M. Baker. *J. Eng. Ed. 49,* 131 (1958) Nov. (5 pp.)

Article proposes to demonstrate that research inherently demonstrates creativity and that to a certain extent is a prerequisite for effective teaching.

Safety

Explosion Protection Operating Experience. G. J. Grabowski. *Nat. Fire Protect. Assoc. Quarterly 52,* 109 (1958) Oct. (11 pp.)

Explosion suppression technique has been developed into a practical form of a passive defense system for aircraft and, based upon these same concepts, there is now available similar equipment to protect industrial explosion risks. Results of study of dust and vapor explosions.

2. ENERGY SUPPLY AND ECONOMICS

Canadian Exports

Oil Men Unhappy with Borden Report. *Oil Gas J. 56,* 45 (1958) Nov. 3 (3 pp.); **Royal Commission on Energy.** First Report. (1958) Oct. (152 pp. incl. intro. and appen.); **Canada's Board O.K.'s Gas Exports; Diefenbaker Pledges Early Action.** *Bus. Week 1522,* 36 (1958) Nov. 1.

Borden Commission is asking Canadian Government to: 1) regulate tariffs of oil and gas pipelines through present Board of Transport Commissioners for Canada; 2) license export and import of oil and gas or other forms of energy through a new agency, the National Energy Board. In addition the commission recognized that Western Canada's reserves are sufficient to support a program of gas exports and attacked original financing and pricing policies of Westcoast Transmission Co. and the export agreement of Trans-Canada Pipe Lines Lts.

Healthy Manhood Is Predicted for West Canada's Infant Natural Gas Industry. J. G. Stabback. *Oil Gas J. 56,* 69 (1958) Oct. 27 (6 pp.)

Discussion of that part of western Canada containing the western Canada sedimentary basin. Area of some 70,000 sq miles is believed to contain 23.6 trillion CF of gas reserves. These are defined as 100% of the proven reserves plus 50% of the probable reserves, all on terms of pipeline gas. Tabulated reserves, requirements, processing plants and graphical representation of gas and products are given.

Gas Reserves

A New Look at Ultimate Natural Gas Reserves. R. L. Miller. *World Oil 147,* 222 (1958) Oct. (3 pp.)

Author develops optimistic viewpoint on geologic estimates of natural gas reserves. He compares the 1950-52 gas data of Weeks, Terry and the Paley report with the present estimated "Impact report" based on 200 and 300 billion bbl of oil reserves which would indicate 1150 and 1700 trillion CF of gas, respectively. This ultimate reserve would delay the arrival of the crest and decline in total gas supply beyond the 1970 crest, perhaps as much as 40-50 years.

Oil Shale

Gasification of Shale with a Solid Heat Carrier. M. K. Pismen, V. G. Ermakov and Yu. I. Belyanin. *Gazovaya Prom.,* 21 (1958) No. 9 (7 pp. Russian text.)

Operation of a pilot plant processing 50 metric tons of Baltic shale/day is described. Shale ash is used as a heat carrier to gasify pulverized shale at 500-

650°C. Gasifier residue and make-up shale are gasified in a separate fluidized bed furnace to produce the hot (800°C) ash. Products are gas (11,615 kilocalories/m^3, 80-150 m^3/ton of shale to gasifier) and light tar (20-30 kg/ton of shale to gasifier). Proposed scheme for further processing of products is described.

J. W. Penney

Energy Sources

Energy Conference Takes Long Look at Future Needs. *Oil Gas J. 56,* 56 (1958) Oct. 27 (3 pp.)

Predictions of speakers include: Space age will need oil and petrochemical because fuels of the future will be linked to petroleum. Market for brains still big (E. V. Murphree, president, Esso Res. & Eng. Co.). Atomic energy will boom at turn of century when fossil fuels start failing to satisfy world's enormous demands for new energy (C. C. Furnas, chancellor, University of Buffalo). Sun can play a vital role in meeting strain. But its specific uses still depend on solving some problems in chemical reactions (G. O. G. Lof, member, research staff, Resources for the Future). Shale oil is coming of age with greater energy demand creating market. Costs of shale oil, however, soon will be under those for crude(C. H. Prien, chemical division director, University of Denver's Research Institute).

Fuels and Power in Manufacturing Industries. W. H. Voskuil. (Urbana, Ill.: Illinois State Geological Survey Circ. 259, 1958.)

Study compares quantities and costs of each of the fuels used in manufacturing 1947 and 1954, according to reports by the Bureau of the Census, which classified the industries into 20 manufacturing groups. Thermal value of each fuel is converted into Btu's and costs are computed in cents/million Btu's for each fuel. Changes in the cost of each fuel and in the quantity and cost per worker are reported for each manufacturing group. Cost of fuel is compared with wages paid in the industry, and changes in the ratio of fuel costs to wage costs are also reported for each industry.

Fuel Cells

Hydrogen, Ethane Power Fuel Cells. *Chem. Eng. 65,* 49 (1958) Nov. 3.

Two announcements revealed further progress in the development of fuel cells. Allis-Chalmers has unveiled a hydrogen-oxygen fuel cell that is claimed to have the highest voltage-to-volume ratio yet achieved. Meanwhile, Esso Research & Engineering claims major breakthrough in an ethane-air cell, details of which are confidential.

Nuclear Energy

The Role of the Electric Utility Industry in the Nuclear Power Field. H. B. Cohn. *Public Util. Fortnightly 62,* 807 (1958) Nov. 6 (10 pp.)

Addition of an entirely new and largely freightless fuel is of great importance to utility industry not only in terms of an additional fuel resource but also in its potential for exerting a competitive restraint on the delivered cost of alternative fuels. It also represents a possible technological advance in the direction of achieving more economical generation of electric power.

Coal

Some Investigations with a Small Cyclone Combustor. H. R. Hoy, A. G. Roberts and D. M. Wilkins. *J. Inst. Fuel 31,* 429 (1958) Oct. (33 pp.)

Investigations of performance of a small experimental slagging cyclone combustor are described. Combustor, 3 ft diam and 3 ft high, has been operated with fine coal of high ash content at combustion intensities up to 8 therms/CF/hr. Combustor was developed as part of a program of research on solid-fuel firing for gas turbines, but in recent years investigations have been conducted to study behavior of the combustor with English coal of the type widely used for power generation.

3. NATURAL GAS AND PETROLEUM PRODUCTION

Air Drilling

A New Technique in Air and Gas Drilling. F. W. Smith. *Petrol. Eng. 30,* B-37 (1958) Oct. (3 pp.)

Detergent injected with water behind compressors combats water intrusion. Foaming mixture can be slugged to handle large amount of water flow. Dry chemicals handle small amounts of water influx.

Water Shutoff in Air/Gas Drilling. C. R. Graham. *Petrol. Eng. 30,* B-24 (1958) Oct. (4 pp.)

Total shutoff of formation water while air and gas drilling is possible, but costly. Many areas where water intrusion has nullified air and gas drilling attempts may now be reconsidered in light of recent developments. At least five organizations are actively developing various treatments designed to effect total water shutoff at low cost and with little rig downtime. Promising new treatments being field tested include polymeric water gel, low viscosity resin, resin slurry and alum-ammonia.

Drilling

Drilling Contractor's Viewpoint. J. W. Williamson. *Petrol. Eng. 30,* B-19 (1958) Oct. (5 pp.)

Article presents viewpoint on profits, losses, prices, equipment, methods and future of contract drilling. Contractors need relief from an over supply of rigs and too low prices. To get a fair price, capable contractors need to go on the offensive.

Efficient Drilling Practices Pay Off in Record Gulf Coast Operations. E. C. Hellums and J. F. Earl. *World Oil 147,* 140 (1958) Oct. (3 pp.)

Record time on two wells drilled in the Caillou Island area of Louisiana has been attributed to cooperation of crew members and efficient operation of rig equipment. These factors made record possible: high rotary rpm, excellent drilling hydraulics, good mud characteristics for fast penetration, fairly high bit loading for Gulf Coast, previous drilling experience in the field and drilling crew cooperation.

Jet Deflection Drilling. R. W. Scott. *World Oil 147,* 137 (1958) Oct. (3 pp.)

Conventional jet bits are used in lieu of whipstocks to drill directional wells in the Gulf Coast and offshore areas of Texas and Louisiana. Overall directional job costs are being reduced considerably through application of jet technique.

Maximum Horsepower Where It Counts. R. W. Colebrook. *Petrol. Eng. 30,* B-77 (1958) Oct. (4 pp); Maximum Hydraulic Power at the Bit. *World Oil 147,* 168 (1958) Oct. (5 pp.)

Optimum hydraulic power at bottom of drill string results from an analysis of pressure and flow characteristics of downhole equipment. Power used to pump mud on drilling rigs is increasing steadily. The 500-1000 hp mud systems put in service a decade ago are being replaced by 1500-2000 hp systems. Even more powerful systems will probably be used in the future.

Mechanical vs Electric Drive for Rigs. W. P. Stephens and A. H. Candee. *Oil Gas J. 56,* 90 (1958) Oct. 20 (4 pp.)

Direct drive from engines of a drilling rig to the draw works and to the slush pumps is practical and the system has inherent advantages. Electric drive has some advantages, too, now that high-power lightweight equipment is available. Article compares the two types.

Overseas Opportunity in Contract Drilling. J. Rundle. *Petrol. Eng. 30,* B-42 (1958) Oct. (4 pp.)

Years of successful operations abroad, experienced by Loffland Brothers Company, is attributable to teams of specialists, experience, and sound investments and ability to offer contract bids in every conceivable form. Explanation of company's many foreign ventures.

Save $5000 Per Completed Well. C. M. Ashby, Jr. *Petrol. Eng. 30,* B-33 (1958) Oct. (4 pp.)

Quick moves, with highly portable rig, fast drilling, 4½-in. casing in 6¼-in. holes provide an economic advantage in the Nebraska and Colorado regions.

Geology

Optical Analog Computer Simplifies Gravity Analysis R. W. Baltosser and S. W. Wilcox. *World Oil 147,* 188 (1958) Oct. (3 pp.)

Operators can determine accurate gravity values from easily modified geologic models. Basic principles permit instrument's adaptation to many potential field problems. Model is made by drawing to scale cross sections or sketches which detail assumed or real earth-density distributions. When model is placed in instrument, readings obtained are equivalent to gravity values.

Offshore Operations

CATC Tackles Big Well-Killing Job. *Oil Gas J. 56,* 43 (1958) Oct. 27 (3 pp.)

CATC's fire off Louisiana has oil industry looking carefully at offshore production techniques. Catastrophe points to inherent dangers of multiwell platforms—particularly where wells themselves are multiple completions. Two wells still burning in mid-October had been producing from seven formations. One was a quadruple completion and the other a triple.

Reservoir Engineering

Gas Reservoir Material Balance Can Be Helpful. F. W. Cole. *World Oil 147,* 182 (1958) Oct.

Gas reserves, expected ultimate recovery, rate of production with time and effects of water encroachment can be attained by method described.

How to Determine Effective Porosity. E. T. Guerrero and F. M. Stewart. *Oil Gas J. 56,* 86 (1958) Oct. 27 (2 pp.)

Introductory article to a series on reservoir engineering begins with concepts of rock and fluid properties as measured in laboratory and from field data. Articles will contain a minimum of theory and maximum of practical application. First article discusses determination of effective porosity by means of a Washburn-Bunting porosimeter, flood-pot data and retort and mercury injection data.

Well Practice

Cementing Procedures. E. H. Clarke, Jr. and A. S.

Murray. *Oil Gas J. 56,* 7 (1958) Aug. 25 (4 pp.); *Ibid.,* 179 (1958) Sept. 1 (2 pp.); *Ibid.,* 226 (1958) Sept. 15 (3 pp.)

Investigation has been conducted to evaluate recommended procedures for new casing and cementing practices. Results show: wells can be cemented with good assurance of success if current information is carefully studied, field tests are performed to establish technique and this proven technique is used to define field procedure. Primary cementing data are necessary to evaluate well performance and may be used to augment reservoir and geological information; when a problem well is encountered it is possible to follow a method of study which will disclose the cause of the trouble. Prior to cementing each well a procedure should be established which can affect the success of a primary cement job. Case history on 5000-foot well is given.

Engineered Completions Increase Oil Recovery. R. W. Coburn. *World Oil 147,* 173 (1958) Oct. (7 pp.)

Selective perforating, reduced shot density and engineered stage fracturing will result in more effective reservoir drainage, more effective use of reservoir energy and greater ultimate recovery. Completion costs can be reduced as much as 25%.

Two Devices May Provide Protection from Blowout. W. E. Harrelson and J. E. Ortloff. *Oil Gas J. 56,* 74 (1958) Oct. 27 (6 pp.); **Blowouts Can Be Controlled with Stinger Closure Device.** *Drilling 19,* 80 (1958) Oct. (2 pp.); presented at AAODC meeting, Dallas, Oct. 1958.

The stinger, an anchored double-acting hydraulic cylinder with a packer attached to the end of the piston rod, and a wrap-around and overshot closure device are two new and very effective tools for surface protection.

Well Productivity

Newest Drillstem Testing Technique. C. D. Hatfield. *Petrol. Eng. 30,* B-60 (1958) Oct. (5 pp.)

New method of drillstem testing provides reliable data on 1) average effective permeability within the drainage area of the well; 2) wellbore damage or skin effect; 3) true formation processes, and 4) well productivities.

Well Tools

Bore Hole Apparatus. F. L. Barreteau (assigned to Schlumberger Well Surveying Corp. U. S. 2,855,685 (1958) Oct. 14.

Improved bore hole device is claimed for determining thickness of mud cake on walls of a well bore. It is comprised of wall-engaging members pivotally mounted on a central carrier for non-penetrating engagement with the wall, and a means of displacing these members away from and toward the carrier. One wall member carries a pivoted, cutting edge for penetrating engagement with the wall with a means for indicating relative movement between wall and cutting member.

4. GAS CONDITIONING AND LPG RECOVERY

Condensate Plants

5,000 Bbl. Liquids Daily from 300 MMCF of Pipeline Gas. L. Resen. *Oil Gas J. 56,* 100 (1958) Oct. 20 (2 pp.)

Low concentration of liquids in gas which has an average 0.67 gal/1 MCF requires low-temperature processing at minus 40°F. Low temperature requires that the gas be dehydrated before refrigeration. These aspects contributed to the building of a plant with interesting design features—the new $6,000,000 Eunice extraction plant in Louisiana.

"Miniature Plants" on the Upswing. G. F. Russell and L. Resen. *Oil Gas J. 56,* 137 (1958) Oct. 13 (3 pp.)

Small-scale field processing plant is coming into its own. Economic picture has brightened in recent years to make the "mini plant" practical. Sixty-three plants, each of which processes 5 million CF or less of gas/day, are now in operation.

Status of Technical Development of Portable Natural Gas Treating Plants. H. C. Fries. *Erdol u. Kohle 11,* 632 (1958) Sept. (4 pp. German text.)

General review of current production of natural gasoline and liquefied petroleum gases, and the plants in use. Adsorption, reflux condensation and refrigeration plants are described and illustrations and flow sheets are given.

Helium

Interior Department Proposes to Increase Helium Supply, Encourage Private Capital. *Gas Age 122,* 34 (1958) Oct. 16 (2 pp.)

Seaton proposal would permit long-term contracts with private industry for helium production, and up to 12 new extracting plants on helium-bearing gas pipelines, to supply increasing need for the gas for the nation's missile and atomic energy programs as well as growing industrial uses.

Hydrogen Sulfide

The Causes of Hydrogen Sulphide Evolution from

Manox at Higginshaw. J. S. Whittaker and R. J. Bramhall. *Gas. J. 296,* 23 (1958) Oct. 1 (9 pp.); **Investigations into Evolution.** J. S. Whittaker and R. J. Bramhall. *Gas World 148,* 730 (1958) Oct. 18 (5 pp.)

Article cites reaction between water vapor and sulfur as cause of hydrogen sulfide evolution from new Manox at Higginshaw. Reaction arises as a result of an oxygen remover in the oxide, which pushes the equilibrium of the reaction in a direction which is favorable to hydrogen sulfide evolution. Main oxygen remover is free iron present with the aniline mud. Less important agent for oxygen removal is bacteria present in the sawdust. Free iron cannot act, however, unless oxide contains sulfur evenly distributed throughout its mass. This is the reason why Manox evolves hydrogen sulfide on occasions while other oxides do not. Various inhibitors can be used to prevent hydrogen sulfide evolution but it appears that most satisfactory solution would be for pre-oxidation of the free iron present in the aniline mud at the manufacturing end of the process.

Hydrogen Sulfide Removal

New Two-Way Process Sweetens Gas and Recovers Sulfur. L. S. Reid and F. M. Townsend. *Oil Gas J. 56,* 120 (1958) Oct. 13 (4 pp.)

Description of one-step process for conversion of hydrogen sulfide in sour gas to elemental sulfur. Process has been developed to pilot plant stage.

5. NATURAL GAS TRANSMISSION

Compressors

How Important Are Fuel Costs in Natural Gas Compressor Drivers? *Gas Age 122,* 26 (1958) Oct. 16 (2 pp.)

Ford, Bacon & Davis, Inc., New York City, have developed a more realistic method of evaluation. Firm believes that what should be asked for is the compressor manufacturers guaranteeing fuel consumption per million standard CF of gas compressed by the equipment over a range of specified compression ratios rather than the Btu consumption per brake horsepower hours of the driver or prime mover alone.

Compressor Stations

Minimum Practical Housing of Low Cost Compressor Stations. B. J. Thompson. *Petrol. Eng. 30,* D-19 (1958) Oct.

Compressor facilities can be installed and operated successfully without any housing. Location will generally determine whether or not housing is required. Installations located in mild climate are commonly unhoused. Those in severe climates have need for, and are usually provided with, complete buildings. To date, records are insufficient to determine whether or not long range maintenance costs for unhoused units will be any greater than for housed units.

New Look in Peak Load Compression. W. H. Krammes and H. C. V. Heyden. *Gas Age 122,* 36 (1958) Oct. 16 (6 pp.)

Unitization of compressor units, acoustical treatment, preheating system for quick starting and safety provisions are key features of Southern California Gas Co.'s modern $4,650,000 compressor station. Extent of automation is indicated by small crew necessary for operation.

Philosophy of Telecontrol of Reciprocating Gas Engine Compressors. F. V. Long. *Pipe Line News 30,* 39 (1958) Oct. (10 pp.); **A Philosophy of Tele-trol of Reciprocating Gas Engine Compressor Units.** F. V. Long. *Gas 34,* 100 (1958) Nov. (9 pp.).

Description of Linden, N. J., station of Texas Eastern Transmission Corp. which marks first use of unattended operation of a large size reciprocating compressor. General discussion of telecontrol of reciprocating gas compressor stations also is included. Article mentions that a manual of operation pertaining to three Linden compressor units is being prepared.

Transducers Protect Large Centrifugal Pipeline Pumps. W. W. Holt, Jr. *Oil Gas J. 56,* 71 (1958) Nov. 3 (3 pp.)

Custom-built protective devices for pressure, temperature and vibration have succeeded and become standard instrumentation. This new electronic equipment was developed for large unattended pumping units because available equipment was inadequate. In addition to providing more accuracy and better repeatabilities, it has increased rates of response of the temperature, pressure and vibration shutdown functions.

Engines

Combustion-air Conditioning—a Passing Fad? W. R. Crooks. *Oil Gas J. 56,* 84 (1958) Oct. 20 (6 pp.)

Article evaluates place of combustion-air conditioning for pipeline engines with natural gas fuel internal combustion engines. Reports that this technique is a necessity for engines when higher specific output and low fuel consumption are desired.

LPG Transportation

Transportation: Our Greatest Expense Item. C. C. Turner. *LP-Gas 18,* 42 (1958) Oct. (3 pp.)

Greatest item of expense in LPG business is cost of transportation. There are sections of the U. S. where the cost of moving LPG from its point of origin to local distributing area is four times as much as the cost of the product itself. There are hundreds of LPG operators outside of zones where tractor-trailer units can operate profitably. Cost of bulk deliveries to consumers is an intricate study in itself. There are many conflicting policies in bulk operations.

Pipeline Construction

Biggest 36-In. Looping Project Laid at Fast Pace. *Oil Gas J. 56,* 52 (1958) Nov. 3 (2 pp.)

Distribution companies in Chicago and other market areas in Iowa and Illinois will be able to expand service because of a rush project by Natural Gas Pipeline Co. of America. Each of five spreads moves ahead 1-2 miles/day, building 514 miles of line between the Texas Panhandle and Joliet, Ill., in an $82-million expansion program. Capacity will be increased 100,000,000 CF/day.

How to Calculate Pipe Stress in Offshore Construction. N. Roads. *Petrol. Eng. 30,* D-20 (1958) Oct. (4 pp.); Pipe Stress in Offshore Construction. N. Roads. *Pipe Line Ind. 9,* 51 (1958) Oct. (4 pp.)

Although the stiffening effect of concrete coating tends to reduce stresses in pipe being laid offshore, the reduction is negligible and is ignored in these calculations. Other factors not considered in the calculations are 1) wave and current forces; 2) possible adhesion of silt or sea life to pipe; 3) tension or compression in pipe; 4) fact that buoyant force is not continuous, and 5) tolerances on pipe and coating.

Telemetering

Telemetering and Remote Control Equipment. G. C. Wilson. *Gas Age 122,* 30 (1958) Oct. 16 (4 pp.)

Most users of telemetering are concerned about the cost of transmission circuitry. They also are interested in the incorporation of remote control and/or supervisory control to the telemetering system. Exchange of experiences within working committees could lead to development of systems with superior modes of operation and consistent with the industry's high safety standards.

Microwave Radio Control Developments. V. L. Ackerman and W. K. Lewright. *World Oil 147,* 203 (1958) Oct. (4 pp.)

Microwave controlled production facilities in the Gulf of Mexico are reducing operating costs for the Pure Oil Company. Program has contributed to solution of several problems confronting designers of offshore telemetering and supervisory control systems.

6. GAS AND LPG STORAGE

Underground Storage

Experience with Pressure Measurement by the Maihak Method at the Engelbostel Gas Storage and a Study of the Measurement Transmitter. Part 1. Pressure Measurements in Engelbostel Storage. H. Just and E. Diekmann. *Erdol u. Kohle 11,* 606 (1958) Sept. (3 pp. German text); **Part 2. Study of Maihak Pressure Detector Under Electrical Influence.** W. Lindrum and K. G. Wagener. *Ibid.,* 608 (1958) Sept. (4 pp. German text.)

Since mid-1953, coke oven gas has been stored at Engelbostel in a sand formation about 650-ft. deep. Volume stored and sendouts have been controlled by pressure records from Maihak pressure-transmitters placed in several boreholes. These pressure records began to show great deviations in 1956 and instruments then were studied by Schering Electrotechnic Institute to determine causes of deviation. Part 2 gives results by the Schering investigators who found that electrostatic fields (earth currents or thunderstorms) caused disturbances in the electromagnetic system. Proper screening and grounding of the electrical system to solve such troubles is discussed.

The Herscher Story—Final Edition. *Monitor 3,* 4 (1958) Nov.-Dec. (7 pp.)

In addition to reduction of total drilling time at least threefold, turbodrilling in the Herscher Dome program has proven to have these important advantages over the rotary: release of one drilling rig to perform other important work, considerable less maintenance and depreciation on the drilling rigs and earlier completion of the drilling program.

How to Find an 'Aquifer' Gas Storage Field. D. Ball. *Gas 34,* 95 (1958) Nov. (5 pp.)

Almost all porous and permeable rocks under the surface contain water or brine and are properly called "aquifers," and most petroleum-bearing reservoirs are aquifers away from the petroleum accumulations, but gas storages in reservoirs barren of petroleum before the first gas injection are called "aquifer storages". Article cautions reader not to be misled into thinking that any aquifer, anywhere, can be used for a storage field. Procedure to follow in search will vary with the area, but step one in almost any search is a compilation of existing knowledge of geologic conditions.

Ohio Farmland Used for LP-Gas Storage. J. J. Pareti. *LP-Gas 18,* 55 (1958) Oct. (2 pp.)

Just 30 miles from Cincinnati work is now in progress in a former cornfield on the boring of a 12,000,000 gal underground storage terminal for LPG. In-

teresting sidelight: all drilling equipment being used to create the caverns is powered by LPG.

Underground Storage to Provide Standby Reserve for Cincinnati. *Gas Age 122,* 23 (1958) Oct. 16 (3 pp.)

Investment of $700,000 will give Cincinnati Gas & Electric Co. an LP storage cavern. This in addition to a $1 million processing plant will give 50 MMCF/day potential for peak shaving.

7. MANUFACTURED GAS AND CHEMICAL PROCESSING

Catalysts

Catalysts of the BASF. W. Jackh. *Erdol u. Kohle 11,* 625 (1958) Sept. (5 pp. German text.)

Review of properties and uses of catalysts in the Badische Anilin-und Soda-Fabrik AG in the processes of sulfur oxidation, ammonia synthesis, hydrogen production, CO-H conversion, organic reactions, pressure hydrogenation, hydrocarbon refining, dehydrogenation and cracking.

Coke

Changes in the Pore Structure of Coke During Carbonization and Gasification. A. Cameron and W. O. Stacy. *Australian J. Appl. Sci. 9,* 283 (1958) Sept. (20 pp.)

Compressibility of coke decreases with increase in carbonization temperature to 800°C and then remains constant. During gasification of coke at 800°C with steam, reaction occurs at all the internal surfaces of the coke and constrictions in the macro- and micropores are gradually removed. Micropore structure becomes increasingly accessible to larger molecules, and pores with entrance diameters in the range 10-400A are detectable after approximately 40% of the carbon has been gasified.

Ethylene

Kinetics of the Thermal Reactions of Ethylene. G. Dahlgren, Jr. and J. E. Douglas. *J. of Amer. Chem. Soc. 80,* 5108 (1958) Oct. 5 (3 pp.)

Ethylene was pyrolyzed at temperatures from 480 to 582° and at pressures from 0.9 to 13.7 cm. Analyses of the reaction products were made at intervals. Primary products were propene, butene, butadiene and ethene. Propane is formed by a second-order, free radical process which is inhibited by hydrogen sulfide. Possible processes are discussed.

Liquefaction

Big Freeze Boosts Heavy-Water Flow. *Chem. Week 83,* 83 (1958) Nov. 1.

L'Air Liquide Co. recently announced that it is going onstream with a revamped version of its low-temperature heavy-hydrogen distillation plant at Toulouse, France. With new installation, said to be adaptable to any size of plant, Air Liquide claims a clear head start in commercializing ultracold separation technique.

Methane

Soviets Studying Bio-Energy Plants. A. J. Steiger. *Am. Gas J. 185,* 29 (1958) Oct. (2 pp.)

Still in experimental stage, production of high-methane content fuel gas from anaerobic decomposition of farm wastes and sewage is seen as potentially huge source of economical gas supply for Europe and other areas of the world lacking natural gas reserves.

Oil Gas

Modern Processes for Production of City Gas from Petroleum Products (Colloquium, DVGW and Gas Institute, Karlsruke, Germany. June 19, 1958). *Gas-u Wasserfach 99,* 921 (1958) Sept. 12 (14 pp. German text.)

Condensations are given of papers presented as follows, after introduction by Prof. H. Pichler; Section A. Plants for cracking liquid hydrocarbons, comprising papers on (1) thermal processes by P. Schenk, H. Koppers plant; T. Hederer, Ibing plants; W. Spaeth, Ibeg plants; and on (2) catalytic processes by M. Raschig, DEMAG-ONIA-GEGI plants; and H. Deneke, Didier-SEGAS plants; Section B. Plants for cracking gaseous hydrocarbons comprising (1) thermal processes, including papers by O. Kroener, Bremen, on Koppers plant; G. Duewel on the Hamburg and Boostedt Koppers plants; and on catalytic process including G. Duewel on the Tiefstack Lurgi plant; E. Baufeldt on the Otto plants; H. Muellers on Ibing plants; Section C Injection of Mineral Oils into Classical Gas and Coke Retorts, which includes F. Wurz, Baden-Baden plant; H. Rehling, Buende plant; Dr. K. Restow, DOG plant; Dr. Cordell, Freeburg coal and oil carburetted plants by Otto-Ibeg.

Radioactivity Applications

The Effect of Gamma Radiation on Pure Hydrocarbons: Methane. G. W. Crawford and J. F. O'Briant. *Proc. Eleventh Oil Recovery Con.* Univ. Texas Bulletin No. 67 (1958) 189 (9 pp.)

New materials are created when high energy electromagnetic waves irradiate a material. Gamma rays and electrons of the material collide and molecules are ruptured, producing free radicals, which may recombine to form new molecules. Purpose of study

is to ascertain whether recombination process can be so controlled that the viscosity of heavy crude oil is reduced. More specifically, new materials which are created by gamma irradiation of pure hydrocarbons as a function of rate of irradiation, total irradiation, temperature and pressure of the sample are determined.

Acetylene

Process for the Concentration and Purification of Acetylene in Gases Formed in the Pyrolysis of Hydrocarbons. F. F. A. Braconier and J. J. L. E. Riga (assigned to Soc. Belge de l'Azote et des Produits Chimiques du Marly.) U. S. 2,856,258 (1958) Oct. 14.

Pure acetylene is recovered from pyrolysis gases by first scrubbing the latter with aqueous ammonia to remove CO_2; second, cooling in a heat exchanger to remove condensable gases (water and benzene); third, scrubbing with liquid ammonia under pressure to dissolve acetylenes and leave a residual non-condensable gas which is used in the second-stage heat exchanger; fourth, scrubbing non-condensable gases with water to get aqueous ammonia for first-stage scrubber, and fifth, distilling under pressure the liquid ammonia solution to recover pure acetylene overhead. Condensables may also be removed by direct contact with cooled methanol.

Process for the Production of Acetylene by Incomplete Combustion of Hydrocarbons. H. Sachsse, T. Kosbahn and E. Lehrer (assigned to Badische Anilin & Soda Fabrik AG.) U. S. Re 24,550 (1958) Oct. 14 (of U. S. 2,664,450 (1953) Dec. 29).

In this process for producing acetylene by incomplete combustion of preheated hydrocarbons, the claims are amended by locating the methane supply tube concentrically around, instead of within, the oxygen supply tube.

Hydrogen Sulfide

Recovery of Hydrogen Sulphide from Waste Sludge Acid. J. Kamlet. U. S. 2,856,267 (1958) Oct. 14.

Valuable products are recovered from the waste sludge acid from refining of petroleum and coal tar hydrocarbons by a simple novel process. Sludge is mixed with a sulfide of an alkali or alkaline earth metal in a closed vessel and the hydrogen sulfide evolved is recovered. After this reaction is completed, mixture is heated to 600-1300°C which reduces the mass to further recoverable H_2S and the metal sulfide, which latter can be recycled.

8. GAS DISTRIBUTION

Peak Loads

Nine LPG-Air Plants Enable Utility to Meet Peak Demands. O. F. Nelson. *Gas 34,* 43 (1958) Nov. (4 pp.)

Description of how Northern Illinois Gas Co. copes with problem of obtaining adequate supplies for peak shaving use. Peak shavings are obtained from storage or manufactured gas, either propane or oil-gas. About 6.5 billion CF of storage gas is available with a maximum withdrawal rate of 138 MMCF/day and maintenance of oil-gas machines which will add 19 MMCF/day. Nine propane-air plants strategically located, which have a total daily sendout capacity of 70 MMCF, help meet balance of peak shaving load.

Soil Properties

A Method to Describe Soil Temperature Variation. E. B. Penrod, W. W. Walton and D. V. Terrell. *Proc. Amer. Soc. Civ. Engrs. 84,* Pap. 1537 (1958) Feb. (22 pp.); Rev. 4251, *Appl. Mech. Rev. 11,* 573 (1958) Oct.

Equation is given for calculating monthly variation of soil temperature at various depths. Observed data are used to determine equation constants for particular soils involved. Agreement with actual measurements at different localities is reasonable. Precipitation is accounted for only indirectly through determination of constants from measured soil temperatures. No method is given for finding the numerical value of constants from primary climatic factors such as dry-bulb temperature, solar radiation, etc.

A. Whillier

9. GAS FUEL UTILIZATION AND APPLIANCES

Air Conditioning

Gas Generated Steam Cools Houston Engineers Building. *Heating, Piping and Air Conditioning 30,* 98 (1958) Oct. (2 pp.)

Newly enlarged, remodeled 24,433 sq ft structure uses steam from a 3 million Btu per hr boiler for both heating and air conditioning.

How to Select Right Air Conditioning System for Multi-story Building. M. J. Wilson, *Heating, Piping and Air Conditioning 30,* 103 (1958) Aug. (4 pp.); *Ibid.,* 90 (1958) Oct. (4 pp.)

The many different types of air conditioning systems that are designed and installed today in multi-story, multi-room structures fall into four main categories:

air water, all air, all water, and refrigerant. Their performance characteristics and installation and operating costs vary. In the August issue the author began a discussion of the various systems that make up these categories. He continues this description here. His purpose? To equate performance against overall cost as a guide to system selection.

Flame Research

Oscillation of Diffusion Flames Appearing when there Is a Laminar Flow of the Ignitable Medium. A. I. Maklakov. *Zh. Fiz. Khimii 30,* 708 (1956) No. 3 (Russian text); *Ref. Zh. Mekh.,* (1957) No. 2, Rev. 1572; Rev. 4278, *Appl. Mech. Rev. 11,* 576 (1958) Oct.

Investigations were carried out of flame oscillations for a number of inflammable gases and also of the vapor of such liquids as benzene, kerosene and others, at a determined limit of velocity of flow; these oscillations were periodic for small fuel consumption and aperiodic for large consumption. The velocity limit depends on the diameter, the material used in construction and position of the burner, and also on the nature of the inflammable mixture, but does not depend on the length of the burner. The frequency of the periodic oscillations is equal to 15-10 hert and is almost independent of the nature of the gas and its consumption, but decreases somewhat with increase in the diameter of the burner. At velocities lower than the limit it is possible to arouse periodic oscillations with the aid of a concentric flow of N_2 or CO_2. A qualitative explanation is furnished for the cause of the oscillation phenomenon.

N. Bakhman

Courtesy Referativnyi Zhurnal, USSR
Translation, courtesy Ministry of Supply, England

Precision Flash X-Ray Determination of Density Ratio in Gaseous Detonations. R. E. Duff, H. T. Knight, and J. P. Rink. *Physics of Fluids 1,* 393 (1958) Oct. (6 pp.)

An x-ray densitometer has been used to measure the density ratio across a detonation wave in a number of different gaseous mixtures involving C_2H_2, C_2N_2, or H_2 with O_2 and Kr. In a 3-in. i.d. tube at an initial pressure of 60 cm the density ratios observed were between 1.64 and 1.67. Investigations of the influence on density ratio of tube diameter at constant initial pressure and of initial pressure at constant tube diameter both indicate an extrapolated infinite diameter density ratio of 1.70 for a 0.3 C_2H_2 + 0.3 O_2 + 0.4 Kr mixture. This result is significantly lower than the ratio 1.79 which corresponds to the tangent point on the equilibrium Hugoniot from the initial state. At the present time these observations cannot adequately be explained by detonation theory.

Transition from Slow Burning to Detonation in Gaseous Explosives. F. J. Martin. *Physics of Fluids 1,* 399 (1958) Oct. (9 pp.)

High-speed photographic observations have been made of flame structure, flame velocity, and shock velocity during the transition from slow burning to detonation in acetylene-oxygen mixtures contained in glass pipe at reduced pressures. During intermediate stages the dome-shaped flame travels down the tube at about 800 m/sec and is preceded by a shock wave traveling slightly faster. During the final stages of formation of the detonation wave, the flame changes shape, accelerates, and advances along the walls in an asymmetric manner. The detonation first appears at, or slightly behind, the leading edge of the flame. The final flame acceleration occurs when the Reynolds number of the mass flow between the flame and the preceding shock, based upon the distance traveled by a mass element in the time interval between passage of the shock and the flame through it, is about 10^7. Under these conditions, the development of turbulent regions in the boundary-layer flow ahead of flame appears likely. Changes in flame configuration which result in the final acceleration and the formation of the detonation wave then arise from the faster flame propagation into these turbulent areas than into the free-stream region.

Industrial Heating

Economic Use of Gas in Industry. R. F. Hayman, *Ind. Gas 21,* 10 (1958) Oct. (6 pp.)

Use of a refined fuel can be expensive unless plant is designed for the process which it is intended to serve. Advantages of gas as a fuel are given and their value in improving the quality of production and in raising rates of production of goods and services is illustrated by examples showing benefits of using gas even when cost/therm is much higher than that of alternative fuels.

Pilot Lights

What the Serviceman Should Know about Industrial Combustion Safeguards. *Gas 34,* 47 (1958) Nov. (5 pp.)

To eliminate delays in shutdown after flame failure, electronically controlled combustion safeguards are a necessity for fuel valve shutoff on industrial equipment. Bi-metal element, thermocouple or other mechanical device are insufficient. Three basic types of flame-sensing equipment have been developed: flame resistance or conductivity systems; flame rectification systems, and systems operating on the pulsation or flicker of infrared radiation from the flame and using a photoconductive lead sulfide cell as a sensing means.

Burners

Atmospheric Fuel Gas Burner. O. W. Hahn. U. S. 2,855,032 (1958) Oct. 7.

Improved vertical gas burner is claimed, formed from pairs of identical sheet metal stampings, joined along flanged edges by spot welding to form an elongated flattened entrance, venturi and mixing chamber for gas-air mixture. Ports are formed by crimping a stamped metal comb onto the upper edge of the mixing chamber and closing the central rectangular top opening with a U-shaped plate. Central tubular nozzle formed likewise with side fins fits on the gas-supply orifice and holds the burner assembly.

Gas Burner Construction. G. W. Jensen (assigned to Geo. D. Roper Corp.) U. S. 2,854,069 (1958) Sept. 30.

Gas range burner is claimed which is operative over the entire range of heat outputs from very low to relatively high. Maintaining the flame is achieved at low gas rates by a peripheral groove around the burner connecting the side-firing ports. By providing (radially) intermediate, smaller diameter ports, the flame also is maintained at high rates.

Gas Burner for Space Heating. L. C. Sassmanhausen. U. S. 2,855,988 (1958) Oct. 14.

Simplified lightweight burner for space heating is described. Vertical gas jet opening which enters combustion chamber bears a spider structure which supports a center rod carrying an alloy flame deflector disc, and also supports from its outer ends an outer collar concentric with the burner tube to form an annular passage for secondary air. Collar also supports a pilot burner.

Industrial Gas Burner. A. R. Furczyk (assigned to Selas Corp. of America.) U. S. 2,855,033 (1958) Oct. 7.

Radiant cup-type burner is claimed, designed for insertion through a furnace wall. Helically-grooved metallic distribution member directs air flow in jets centrifugally against a ceramic cup, meeting a radial flow of fuel gas from a retracted central distributor fed by an axial pipe, both air and gas elements enclosed in a cylindrical casing to be flange-mounted.

Nozzle for Gas Burners. C. D. Jones (assigned to Siemon Mfg. Co.) U. S. 2,854,068 (1958) Sept. 30.

Gas burner to be sealed in furnace wall is claimed consisting of a blast tube for air with an axially supported gas feed tube. Gas nozzle is a conically tapered cap screwed onto the forward end of the gas tube, with holes bored in cone wall, and its tip supporting a circular perforated cupped deflector plate. Proportioned flows of gas and air through respective tubes produce an aspirator action ahead of the deflector, resulting in great turbulence and good mixing of gases and in a more stable flame.

Clothes Dryers

Clothes Drier and Condenser Therefor. H. E. Morrison (assigned to Whirlpool Corp.) U. S. 2,853,-798 (1958) Sept. 30.

Clothes dryer is claimed which provides a condenser overlying the dryer drum, said condenser cleaning and dehumidifying the air which is then preheated by a common walled duct on its way to the air heating chamber and passed by fan to the clothes drum.

10. EQUIPMENT AND INSTRUMENTATION

Automation

Pinboard Technique Gives Flexibility to Data-Handling Systems. J. T. Teed. *Oil Gas J. 56,* 91 (1958) Oct. 13 (6 pp.)

Automatic logging system is amenable to a wide range of uses in petroleum and chemical process industries. Technique described enables operator to substitute one type of input for another, rearrange sequence in which the inputs are laid out, change range for input variables and set span, zero suppression and alarm limits.

Computers

Phillips' Sweeney Logger . . . It Helps Ethylene Unit Operators. J. G. Allen and G. L. Smith. *Oil Gas J. 56,* 97 (1958) Oct. 13 (5 pp.)

Cost of high-reliability logger can be justified by a relatively small improvement in pyrolysis product yield. Future step-by-step application calls for tie-in with 1) ethylene-plant accounting procedures; 2) out-of-plant digital computations aimed toward optimum olefin yield; 3) inplant computers for automatic calculation of operating guides, and 4) ultimate closed-loop optimization.

Heat Exchangers

Effective and Local Surface Coefficients in Fin Systems. G. M. Dusinberre. *Trans. ASME 80,* 1596 (1958) Oct. (2 pp.)

When tests are conducted on systems containing extended heat transfer surface, direct result is an "effective" surface coefficient. Desired result is a "local" or true surface coefficient. Article shows how, on reasonable assumptions, one can be calculated from the other without trial-and-error procedures.

Heat Transfer

Thermal Transducers. M. Kovarik. *Australian J. Appl. Sci. 9,* 225 (1958) Sept. (11 pp.)

New type of transducer uses heat propagation in homogeneous solid bodies as the means of transmission of signals. General transducer theory is developed and a fundamental relation for its transfer function derived. Analysis or synthesis of transfer function is possible on the basis of this relation. Analytical method is demonstrated in two examples, leading to design equations for a thermal integrator and a thermal differentiator. Application of the thermal integrator to an automatic control system is described and experimental results are included.

Metering

Accurate Liquid Control. H. G. Davis. *Chem. & Process Eng. 39,* 360 (1958) Oct. (3 pp.)

Brief summary of requirements for efficient storage, distribution and metering of liquids in industry. Each phase must be considered in light of individual requirements. Latest ideas in automatic control also are included.

Pyrometry

A Cooled Gas Pyrometer for Use in High-Temperature Gas Streams. L. N. Krause, R. C. Johnson and G. E. Glawe. *National Advisory Comm. for Aeronautics Tech. Note 4383* (1958) Sept. Cleveland: Lewis Flight Propulsion Laboratory. (Order from NACA, Washington, D. C.)

Immersion-type pyrometer is described which utilizes controlled cooling of a continuously aspirated sample of gas whose temperature is to be measured. Gas is cooled as it is drawn through a tube, after which its temperature is measured with a thermocouple. Free-stream total temperature then is obtained by a relation involving internal heat transfer in the tube, gas properties and certain readily measured temperatures and pressures. Experimental data were obtained with the cooled gas pyrometer in a 2000°-4000°R gas stream.

11. MATERIALS OF CONSTRUCTION, AND CORROSION

Cathodic Protection

Corrosion Protection for Pipe Type Electric Transmission Lines in the Chicago Area. W. T. Rose. *Corrosion 14,* 493t (1958) Oct. (2 pp.)

Pipe type high voltage transmission lines used in the Chicago area were protected with either an asphalt mastic coating or a reinforced coal tar enamel coating. Both are factory applied. Cathodic protection was then applied to these lines to police the pin holes in the coating. Before cathodic protection could be economically applied, it was necessary to insulate the pipes from the station ground busses. It was also necessary to maintain a low resistance path between the pipes and the ground busses for fault current in the event of a service failure. This was accomplished by using oxide film cutout discs in the ground connections. Both magnesium anodes and a rectifier were used to provide cathodic protection.

Current and Potential Relations for the Cathodic Protection of Steel in Salt Water. W. J. Schwerdtfeger. *Corrosion 14,* 446t (1958) Oct. (5 pp.)

Laboratory investigation was conducted on the cathodic protection of steel specimens that were exposed for 60 days to both stagnant and aerated city water to which was added 3% by weight of sodium chloride. Major consideration was given to the significance of potential as a criterion for protection. Optimum protection was achieved when specimens were controlled at -0.77 volt with reference to the saturated calomel half cell. Although a good degree of protection was obtained at controlled potentials more noble than -0.77 volt, that is, at the potentials associated with the breaks in cathodic polarization curves, this lesser degree of protection could not be obtained at lower mean current densities.

High Resistance Soil Problem Solved by Deep Groundbeds. R. L. Bullock. *Petrol. Eng. 30,* D-31 (1958) Oct. (3 pp.)

Successful installation of a deep groundbed in high resistance soil proved that while low resistance soil is preferred, it is not necessary in order to obtain a low resistance groundbed. Deep graphite—coke breeze backfill groundbed has a life expectancy of 20 or more years.

Coatings

New Developments in 'In Situ' Cleaning. P. B. Wharton. *Corrosion Tech. 5,* 319 (1958) Oct. (1 pp.)

It is a prime principle, agreed by all corrosion scientists, that the proper preparation of steel, prior to painting or the application of other coatings, is most essential for long-term protection. Proper preparation means the removal of all rust and millscale leaving a clean, down to bare metal, surface. The only two satisfactory methods of cleaning to 'white metal' are grit-blasting and pickling. It is only possible to pickle efficiently easily handled articles. Use of *Dalex,* a silica-free abrasive, has now made possible the 'in situ' cleaning by grit blasting, of tanks, ships and large structures.

Preparation of Steel Surfaces for Repainting. J. Hurst. *Corrosion Tech. 5,* 313 (1958) Oct. (3 pp.)

Perhaps it is true to say that the correct time to repaint is before it becomes necessary. Unfortunately, the economics of modern industry are such that even in efficient industrial organizations, maintenance is not always rated highly in the priorities of budget expenditure. The ideal at which to aim is the gradual build-up of paint thicknesses, achieved only by repainting at fairly regular intervals, while the original paintwork is still in good condition. If repainting is carried out at this time, preparation can, in the main, be limited to cleaning and perhaps rubbing down of painted surfaces with little necessity for large-scale preparation of the steelwork itself.

Construction Materials

Materials Selector (1958-59 Reference Issue). *Materials in Design Eng. 48,* 1 (1958) Mid-Oct. (478 pp.)

This second annual issue of the *Materials Selector* is similar to but more extensive than last years' issue. It contains 50 new pages of data, including an entirely new section on Joining and Fastening of Materials. The data published last year have been revised to reduce or eliminate errors. In addition, the Directory has been expanded by 50%—it covers more categories and lists more suppliers—and has been brought up to date. Like last year's issue, this *Materials Selector* consists of two major sections: a Data Section and a Directory Section. Each major section is subdivided to make it as useful as possible. In addition, a more detailed contents page appears at the beginning of most subsections. All subsections, numbered from 1 to 6, can be readily located by means of the small edge index tabs.

Corrosion

The Corrosion Resistance of Ductile Iron. F. L. LaQue. *Corrosion 14,* 485t (1958) Oct. (8 pp.)

Internal structure of ordinary grey iron, pearlitic ductile iron, ferritic ductile iron, malleable iron and mild steel are compared. Differences in the amount of carbon present and in the form in which it occurs are responsible for some differences in the corrosion behavior of these materials. This is explained on the basis of the electrochemical reactions which occur during corrosion. As corrosion proceeds, the graphite which is present in the cast materials may accumulate as a graphite layer on the surface. Adherence and permeability of such graphitic layers and their influence on subsequent corrosion and on galvanic behavior are discussed.

High-Temperature Hydrogen Sulphide Corrosion in Refinery Experience. P. W. Sherwood. *Corrosion Tech. 5,* 326 (1958) Oct. (4 pp.)

High-temperature corrosion by H_2S is a new problem in refinery technology. It is associated with catalytic reforming and desulphurisation processes which were introduced during the last 5-7 years.

How CATC Fights Marine Corrosion. R. M. Robinson. *Oil Gas J. 56,* 117 (1958) Oct. 13 (3 pp.)

Corrosion protection system for offshore mobile tank unit has been designed to protect against external corrosion of submerged parts, in the splash zone and in the atmospheric zone. Consideration has been given to internal corrosion in the ballast and oil storage tanks.

Metals

Consider Cr-Mo-V Low Alloy Steels for 1000F Service. C. M. Cosman. *Materials in Design Eng. 48,* 93 (1958) Oct. (4 pp.)

Demands for industrial equipment to operate economically at ever increasing temperatures and pressures have led to development of low alloy steels intended for such services. Low alloy chromium-molybdenum steels have been used for power plant service in this country for a number of years. Experimental work has shown that adding vanadium to this type of steel improves high temperature properties. Article compares long-time properties of chromium-molybdenum-vanadium and other low alloy steels.

12 ANALYTICAL METHODS AND TESTS

Chromatography

Analysis of Fixed and Condensable Gases by Two-Stage Gas Chromatography. J. J. Madison. *Anal. Chem. 30,* 19A (1958) Nov.

A two-stage gas chromatography system using one detector and one recorder is devised for analysis of mixtures of fixed and condensable gases. The condensable gases are separated on a partition column and the fixed gases on an absorption column. The fixed gases are trapped during partitioning and then desorbed and resolved.

Emission Spectrograph

The Determination of Trace Elements in Pulverized-Fuel Ash. A. C. Smith. *J. Appl. Chem. 8,* 636 (1958) Oct. (10 pp.)

Spectrographic methods are described for the determination of 30 trace elements in 18 ashes. No element was present in concentrations sufficient for

economic recovery. Apart from titanium, where the concentration is of the order of 1%, only manganese exceeds 0.1%, while copper, lead, zinc, nickel and chromium fall in the range 0.01-0.1%. Concentrations of other elements are much below 0.01%, while thallium, cadmium, mercury, rubidium, tungsten, silver, zirconium, platinum, indium, palladium, lanthanum and gold were not detected.

Halogens

Determination of Chlorine and Bromine by the High-Temperature Combustion Method. S. W. Nicksic and L. L. Farley. *Anal. Chem.* 30, 15A (1958) Nov.

High temperature combustion apparatus is adopted to determine chlorine and bromine. The sample is burned in an atmosphere of oxygen and the exit gases absorbed in sodium bisulfite solution then titrated with silver nitrate. The method is applicable for analyzing insoluble materials, emulsifying systems, inorganic catalysts and acidic compounds.

Hydrocarbons

Aromatic Hydrocarbons in the 170°C to 180°C Fraction of Petroleum. B. J. Mair, S. P. Davidson, N. C. Krouskop, and F. D. Rossini. *Anal. Chem. 30,* 15A (1958) Nov.

In analysis of hydrocarbons in the aromatic portion of a petroleum sample, seven compounds were found to constitute the 170° to 180°C fraction. These compounds were identified by physical properties and infrared special analysis.

Titrimetric Determination of Unsaturation by Catalytic Hydrogenation. W. Seaman. *Anal. Chem. 30,* 17A (1958) Nov.

A new procedure for determining compound unsaturation by catalytic hydrogenation uses standard amounts of lithium aluminum hydride. After hydrogenation the excess hydrogen reacts with oxygen to form water and is titrated with Karl Fischer reagent. Several unsaturated acids are studied.

Infrared Spectroscopy

Pressure Modulation of Infrared Absorption. I. Entire Vibration-Rotation Bands. J. C. Gilfert and D. Williams. *J. Optical Soc. Am. 48,* 765 (1958) Nov. (5 pp.)

Effects of pressure modulation on total absorption of rotation-vibration bands of carbon monoxide, nitrous oxide, methane and propane have been investigated. Although ultimate limitations of pressure modulation as a detection technique have not yet been completely established, present results are in qualitative agreement with earlier studies. Modulation is of use in distinguishing weak absorption bands from background absorption in the atmosphere. In strong absorption bands, wings are enhanced in the modulated spectrum; in weak bands, modulated spectrum approximates that obtained by conventional methods. Possible applications of pressure modulation are suggested.

Mass Spectrometer

Redetermination of Mass Spectra of Deuteromethanes. F. L. Mohler, V. H. Dibeler and Ed. Quinn. *J. Research 61,* 171 (1958) Sept. (2 pp.)

Mass spectra of the four deuteromethanes have been remeasured using samples of improved isotopic purity. Relative abundances of fragment ions involving loss of H or D atoms from the molecules CH_3D, CH_2D_2 and CHD_3 are not proportional to the a priori probabilities of removing H or D atoms but have been expressed in terms of the a priori probability times a weighting factor. Weighting factor for removing one H or D atom from these molecules can be roughly express as positive and negative powers of a single constant 1.19 ± 0.015 and the same power law holds for the relative abundances of H^+ and D^+. Weighting factors for removing two or more hydrogenic atoms are not consistent with this power law.

Sulfur

Oxygen Lamp for Determination of Sulfur in Fuel Gas. D. M. Mason and C. E. Hummel. *Anal. Chem. 30,* 1885 (1958) Nov. (2 pp.)

Combustion in a lamp using purified air has heretofore been employed, and a number of lamps have been developed for this purpose (5, 6). However, there has been difficulty in obtaining a stable flame when burning certain gases, particularly high-B.t.u. oil gas, and the rate of burning is often less than that desired. Efforts to improve this situation have led to the development of a lamp using only secondary oxygen to support combustion.

Sulfur Oxides

Colorimetric Method for Continuous Recording Analysis of Atmospheric Sulfur Dioxide. H. L. Helwig and C. L. Gordon. *Anal. Chem. 30,* 15A (1958) Nov.

An automatic sampling and recording apparatus is described for the continuous determination of sulfur dioxide in the atmosphere. A red-violet color is produced with an acidic solution of pararosaniline hydrochloride. Limits of detection are below 5 p.p.m.

13. BASIC SCIENCE

Fluid Flow

Relation between Time Symmetry and Reflection Symmetry of Turbulent Fluids. W. C. Meecham. *Physics of Fluids, 1,* 408 (1958) Oct. (3 pp.)

An assumption of statistical reflection symmetry is proposed for certain turbulent flows. On the basis of this assumption it is shown that some space-time velocity correlations characterizing the flow are even functions of the time delay between the correlation measurements. In particular the second- and one of the fourth-order velocity correlations are symmetric in this relative time.

Heat Transfer

Effect of Vibration on Heat Transfer from a Wire to Air in Parallel Flow. R. Anantanarayanan and A. Ramachandran. *Trans. ASME 80,* 1426 (1958) Oct. (7 pp.)

Studies of the effect of vibration of the heat-transferring surface on convective heat transfer are few and are limited to natural-convection conditions. Article describes investigation dealing with influence of vibration on heat transfer from an electrically heated nichrome wire to parallel air streams. Air velocities ranged from 34-63 ft/sec. At each air velocity, frequencies ranging from 75-120 cps and different amplitudes were employed as vibrational variables. Both frequency and amplitude increased with heat transfer coefficient. An increase as high as 130% was obtained. Correlation of experimental data shows that proportional increase in heat transfer was controlled by ratio of mean vibrational velocity to air-stream velocity.

Heat Transfer in Boundary Layers with Chemical Reactions due to Mass Addition. R. Bromberg and R. P. Lipkis. *Jet Propulsion 28,* 668 (1958) Oct. (7 pp.)

Review of essential features of differential equations applicable in the boundary layer with mass transfer at the wall, including consideration of chemical reactions. Brief derivation is given and equations are presented in alternate forms useful for various applications. Special discussion is given of wall boundary conditions because of possible confusion arising from effects of mass transfer at the wall. General formal solution to these equations is obtained which enables determination of the heat transfer potential, subject only to the requirement that Lewis number equal unity, for all possible boundary layer chemical reactions.

Heat Transfer from Horizontal Cylinders to a Turbulent Air Flow. B. G. van der Hegge Zijnen. *Appl. Sci. Res. 7,* 205 (1958) 2/3 (19 pp.); Rev. 4259, *Appl. Mech. Rev. 11,* 574 (1958) Oct.

This is an attempt to rationalize the influence of free-stream turbulence on heat loss from circular cylinders on the basis of extensive new data covering wide ranges of 1) cylinder Reynolds number, 2) free-stream turbulence level, 3) ratio of turbulence integral scale to cylinder diameter. The semi-empirical approach seems reasonable successful, although only qualitative reference is made to the actual fluid dynamical phenomena possibly involved. Perhaps the most interesting result is that, for fixed Reynolds number (in the range from 2000-25,800) and turbulence level, there is an optimum scale-to-diameter ratio for maximizing the Nusselt number.

S. Corrsin

Heat Transfer from Town Gas Flames to Water Jacketed Horizontal Tubes. S. R. Tailby and M. D. Ashton. *Trans. Inst. Chem. Engrs. 36,* 1 (1958) No. 1 (12 pp.); Rev. 4276, *Appl. Mech. Rev. 11,* 576 (1958) Oct.

A system in which town gas burns in a horizontal water-cooled tube terminating in a vertical flue is the basis of horizontal gas-fired water boilers. The apparatus, used consisted of a water-cooled tube, 12-ft long and 3-in. diam, with a gas burner firing into one end and a 7-ft vertical flue mounted on the opposite end. The tube was constructed so that the heat-transfer rate could be determined for each foot along the length of the tube. Variables investigated were primary air-to-gas ratio, gas burner characteristics, entrained excess air and tube length. The effect of heat input was also investigated. Data given show the effect of the variables on thermal efficiency, local heat-transfer rates along the tube, radiation and flame length. Radiation measurements were made to study the flame properties. It was found that the effect of altering heat input was highly significant but the other variables seldom had an effect on the system other than the effects resulting from the accompanying change in heat input.

R. C. Nevins

Mass Transfer

Boundary Layers with Chemical Reactions due to Mass Addition. C. B. Cohen, R. Bromberg and R. P. Lipkis. *Jet Propulsion 28,* 659 (1958) Oct. (10 pp.)

Analysis is concerned with essential features of chemical interaction between a gaseous boundary layer and sublimed or ablated material from a body surface or gas injected through a porous wall. These effects are in addition to the "blowing" effect of the gas added to the boundary layer. Models studied are those for which diffusion coefficients of all species are equal, the "frozen" Prandtl and Lewis moduli are taken as unity, and reactions proceed at an infinite rate. Solutions are given for three problems: 1) A diffusion-limited irreversible reaction, typified by the oxidation of carbon to carbon monoxide; 2) a temperature-limited irreversible reaction, such as dissociation without recombination and 3) a reversible reaction including complete dissociation and recombination within the boundary layer.

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Applied Spectroscopy
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Battelle Technical Review
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Brennstoff-Chemie (German)
British Coal Utilization Research Association Monthly Bulletin and Quarterly Gazette
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Butane-Propane News

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Canadian Gas Journal
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Canadian Journal of Physics
Ceramics (British)
Chemical and Engineering News
Chemical & Process Engineering
Chemical Education, Journal of
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Chemical Engineering Progress
Chemical Engineering Science
Chemical Processing
Chemical Physics, Journal of
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Chemical Week
Chemistry & Industry (British)
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Faraday Society, Transactions of (British)
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